

# Sublethal Effects of the Carbamate Insecticide—Carbaryl—on Coastal Cutthroat Trout

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## Abstract

Willapa Bay is a coastal estuary in Washington State that provides habitat for cutthroat trout (*Onchorhynchus clarki clarki*). In the estuary, schools of trout forage in shallow water along beaches, around oyster beds, and in patches of eelgrass. Cutthroat trout use the estuary in the summer months when carbaryl, a carbamate insecticide, is applied to oyster beds to control burrowing shrimp populations. Carbaryl is a neuro-toxicant that inhibits acetylcholinesterase, an enzyme that hydrolyzes the transmitter acetylcholine at neuronal and neuromuscular synapses. In the present study we assessed whether cutthroat trout can detect and avoid carbaryl in seawater. We also evaluated the effects of carbaryl on acetylcholinesterase activity using exposure concentrations and durations that are representative of conditions in the estuary on the day of pesticide application. We find that carbaryl does not evoke a measurable response from the cutthroat olfactory epithelium, and that animals do not avoid carbaryl-contaminated seawater in two-choice laboratory tests. Six-hour carbaryl exposures significantly reduced acetylcholinesterase activity in both brain and muscle in a dose-dependent manner. Therefore, carbaryl applications in the estuary may impair the behavioral performance of cutthroat trout and increase the predation vulnerability of exposed animals.